

REMARKS

In view of the above amendments and following remarks, reconsideration of the rejections and further examination are requested.

Claims 1-4 are pending in this application. Claims 1-4 stand rejected. Claims 1-4 are cancelled herein. Claims 5-7 are newly added. No new subject matter has been added.

The specification and abstract have been carefully reviewed and revised to make grammatical and idiomatic improvements in order to aid the Examiner in further consideration of the application. A second substitute specification and abstract including the revisions have been prepared and are submitted herewith. No new matter has been added. Also submitted herewith are marked up copies of the substitute specification and abstract indicating the changes incorporated therein.

The Examiner rejects claims 1-4 under 35 U.S.C. § 112, second paragraph. More specifically, regarding claim 1, the Examiner asserts that there is insufficient antecedent basis for: “the packet” recited in lines 13 and 19 on page 24, and in lines 3 and 6 on page 25; “the next packet” recited in lines 12 and 15 on page 25; and, “the radio communication terminal” in lines 7, 17 and 18 on page 24. Regarding claim 2, the Examiner asserts that “the packet” recited in line 18 on page 25 lacks sufficient antecedent basis. Regarding claim 3, the Examiner asserts that “the packet” in lines 4 and 12 on page 26, and “the next packet” recited in lines 16-17 and 19, on page 26, lack sufficient antecedent basis. The Applicant has addressed the Examiner’s concern by canceling originally filed claims 1-4 and adding new claims 5-7, corresponding to claims 1-3.

For the reasons discussed above, the Applicant respectfully requests that the 35 U.S.C. § 112, second paragraph, rejection of claims 1-4 be withdrawn.

Claims 1-4 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Jo et al. (U.S. Patent Application Publication No. 2003/0112753)(hereinafter referred to as “Jo”) in view of Taketsugu et al. (U.S. Patent No. 5,740,167)(hereinafter referred to as “Taketsugu”). Because claims 1-4 are cancelled herein, the Applicant respectfully requests that the rejection of claims 1-4 under 35 U.S.C. § 103(a) be withdrawn.

The above-mentioned rejection is submitted to be inapplicable to newly added claims 5-7 for the following reasons.

Claim 5 is patentable over the combination of Jo and Taketsugu because claim 5 recites a radio information communicating system for performing radio data communication, including, in part, a local area network including at least one radio communication terminal and an access relaying apparatus. The at least one radio communication terminal includes carrier sensing means, transmission means, and information embedding means for embedding an abandonment time in packets to be successively transmitted to another radio communication terminal or to the access relaying apparatus, wherein the abandonment time is a time until a subsequent packet is to be transmitted, after a previous packet transmission, is abandoned using time-out control. The access relaying apparatus includes reception means, reading means, determination means, and transmission right granting means. The transmission right granting means compulsorily grants a transmission right to transmit the subsequent packet to the at least one radio communication terminal attempting to transmit the subsequent packet when the determination means determines

that the reception means has not received the subsequent packet before the abandonment time elapses.

It should be understood that these features eliminate the need for constant polling and reduce the control load of the access relaying apparatus in a radio information communicating system. Additionally, packets are not abandoned due to time-out because the radio communication terminal is granted the transmission right through polling.

In contrast, Jo discloses a system in which a data packet is transmitted and received between a transmission terminal and a reception terminal. The object of the invention of Jo is to prevent an unnecessary data packet for the reception terminal (data packet having a delay time exceeding a acceptable delay time of an application in the reception terminal) from being transmitted (see par. 0011). A router including a comparator 26 and a packet processing unit is provided between the transmission terminal and the reception terminal. A delay time for a data packet is determined and the comparator 26 compares the delay time with an acceptable delay time of the data packet. The packet processing unit includes AND circuits 27a, 27b, 28a, and 28b, a restructuring unit 29 and a discarding unit 30. The packet processing unit discards the data packet if the delay time is greater than the acceptable delay time based on the comparison result of the comparator, and transfers the data packet if it is not discarded. This prevents the data packet from being transmitted to the reception terminal.

Based on the above discussion, it is apparent that the router of Jo compares a delay time of a data packet with an acceptable delay time of the data packet, and either discards or transfers the data packet depending on the comparison. Moreover, there is no disclosure or suggestion in

Jo to modify the comparator 26 or the packet processing unit to compulsorily grant a transmission right to transmit a subsequent packet to the at least one radio communication terminal attempting to transmit the subsequent packet when a determination means determines that a reception means has not received the subsequent packet before an abandonment time elapses. In other words, the router of Jo does not describe compulsorily granting a transmission right to transmit a subsequent packet, wherein the transmission right is granted to the at least one radio communication terminal attempting to transmit the subsequent packet when a determination means determines that a reception means has not received the subsequent packet before an abandonment time elapses.

Regarding Taketsugu, it is relied upon in the rejection as disclosing carrier means for determining whether a radio transmission line between the other radio communication terminal or the access relaying apparatus and the radio communication terminal is available. Taketsugu discloses a radio communication system including a multiple access method for a common radio channel. However, it is clear that Taketsugu also fails to disclose or suggest the above-discussed features of the claimed radio information communicating system as recited in claim 5.

Therefore, Taketsugu fails to address the deficiencies of Jo. As a result, claim 5, and claim 6 depending therefrom, are patentable over the combination of Jo and Taketsugu.

Regarding claim 7, it is patentable over the references relied upon in the rejection for reasons similar to those set forth above in support of claim 5.

Because of the above-mentioned distinctions, it is believed clear that claims 5-7 are patentable over the references relied upon in the rejection. Furthermore, it is submitted that the


distinctions are such that the person having ordinary skill in the art at the time of invention would not have been motivated to make any combination of the references of record in such a manner as to result in, or otherwise render obvious, the present invention as recited in claims 5-7. Therefore, it is submitted that claims 5-7 are clearly allowable over the prior art of record.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

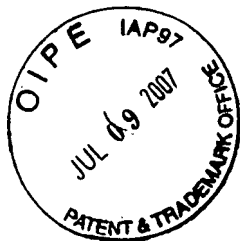
Should the Examiner believe that there are any remaining issues that must be resolved before this application can be passed to issue, it is respectfully requested that the Examiner contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

Takashi MATSUMOTO

By: 
Kevin McDermott
Registration No. 48,113
Attorney for Applicant

KM/km/akl
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
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DESCRIPTION

RADIO INFORMATION COMMUNICATING SYSTEM

BACKGROUND OF THE INVENTION

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1. Field of the Invention~~TECHNICAL FIELD~~

The present invention is an invention relating to a radio information communicating system. More particularly, the present invention is an invention relating to a radio information communicating system in which one access relaying apparatus and one or more radio communication terminals constitute a local network to mutually perform radio data communication.

2. Description of the Related Art~~BACKGROUND ART~~

15 One information communication standard for wireless local area networks (LANs) is IEEE 802.11. For IEEE 802.11, DCF (Distributed Coordination Function) using carrier sense multiple access with collision avoidance (CSMA/CA) is proposed as a standard function.

20 Here, under the above-mentioned DCF, a radio terminal holding a packet monitors a radio transmission line by carrier sensing and if the radio transmission line is open, performs a transmission of the packet. Conversely, if the radio transmission line is not open, the radio terminal retransmits the held packet after an
25 interval determined by a random number based on a back-off process.

Similarly, if a collision between packets occurs, the radio terminal retransmits the aforementioned packet after an interval determined by a random number (e.g., Japanese Laid-Open Patent Publication No. 09-205431).

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~~DISCLOSURE OF THE INVENTION~~ BRIEF SUMMARY OF THE INVENTION

However, while allowing for light control, the aforementioned DCF has a problem described below.

An audio packet has such characteristics that it is abandoned
10 due to time-out if it is held in an unsent state beyond a
predetermined time within a wireless LAN. Here, under the
aforementioned DCF, because of the occurrence of collisions between
packets and a back-off process, a delay in a packet transmission
is prone to happen. Consequently, the aforementioned DCF has a
15 problem in that there is a high possibility of abandoning the audio
packet in an unsent state within the system.

As a method for solving the above-mentioned problem, PCF
(Point Coordination Function) using polling by a radio base station
may be conceivable. PCF is a communication method in which a radio
20 base station sequentially grants each radio terminal a transmission
right and the radio terminal having obtained the transmission right
performs a transmission of a packet. Thus, the radio terminal
having obtained a transmission right can periodically transmit
packets of data ~~to be transmitted~~. As a result, abandonment of
25 an audio packet due to the above-mentioned time-out is less likely

to occur.

Nevertheless, the aforementioned PCF has problems in that, since a radio base station must manage and control all radio terminals, there is a heavy control load, and that because polling
5 is periodically performed even to a radio terminal generating packets in burst fashion, it is ineffective.

Therefore, an object of the present invention is to provide a wireless LAN system which can be controlled, without a heavy load on the whole system, in such a manner that specific data such
10 as audio data will not be abandoned within a radio terminal at the transmitting end due to time-out.

To solve the aforementioned conventional problems, a radio information communicating system of the present invention normally transmits a packet by CSMA/CA-~~technique~~, and when the packet is
15 about to be abandoned due to time-out, an access point (AP) performs polling to a radio terminal which is trying to transmit the packet.

According to the above-mentioned radio information communicating system, an AP does not need to perform polling constantly. As a result, the control load on the AP is reduced.
20 Moreover, because a radio terminal is compulsorily granted a transmission right through polling, abandonment of a packet due to time-out is prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

25 FIG. 1 is a block diagram illustrating ~~the entire~~

~~constitution of a~~ radio information communicating system of the present invention.

FIG. 2 is a diagram illustrating ~~the constitution of a~~ packet used in the radio information communicating system of the present invention.

FIG. 3 is a diagram illustrating ~~the constitution of a~~ radio terminal used in the radio information communicating system of the present invention.

FIG. 4 is a block diagram illustrating ~~the constitution of~~ a Media Access Control Baseband (MAC/BB) processing section included in a radio terminal in the radio information communicating system of the present invention.

FIG. 5 is a diagram illustrating ~~the constitution of an~~ access point (AP) used in the radio information communicating system of the present invention.

FIG. 6 is a block diagram illustrating ~~the constitution of~~ a MAC/BB processing section included in the AP in the radio information communicating system of the present invention.

FIG. 7 is a ~~diagram~~ flowchart illustrating an operation ~~which a frame processing section in~~ performed by the MAC/BB processing section of a radio terminal ~~performs~~ when various areas are embedded to a packet.

FIG. 8 is a ~~diagram~~ flowchart illustrating an operation of an internal CPU of a radio terminal when a packet is stored in a sending/receiving FIFO.

FIG. 9 is a ~~diagram~~ flowchart illustrating the process which the AP performs when receiving a packet.

FIG. 10 is a ~~diagram~~ flowchart illustrating an operation performed by ~~which~~ a MAC/BB processing section 102a of a radio terminal 2a ~~performs~~, when the ~~second and later~~ subsequent packets are transmitted.

~~BEST MODE FOR CARRYING OUT THE INVENTION~~ DETAILED DESCRIPTION OF
THE INVENTION

10 Hereinafter, a radio information communicating system according to an embodiment of the present invention will be described with reference to the figures. FIG. 1 is a block diagram illustrating ~~the entire constitution of the~~ a radio information communicating system according to an embodiment of the present
15 invention.

 The radio information communicating system shown in FIG. 1 comprises an access point (hereafter, referred to as AP) 1 and radio terminals 2a to 2d. This radio information communicating system is a wireless LAN system, in which radio information
20 communications are conducted between each of the radio terminals 2a to 2d or the AP 1. Now, the entire overview of the radio information communicating system shown in FIG. 1 will be briefly described.

 In this radio information communicating system, the AP 1
25 and each of the radio terminals 2a to 2d normally perform data

communication through CSMA/CA-~~technique~~. Specifically, the AP 1 and the radio terminals 2a to 2d perform carrier sensing for a communication path that each device is trying to use, and, if transmission is possible, transmit a packet of data ~~to be~~
5 ~~transmitted to the AP 1 or one of the radio terminal terminals~~ 2a to 2d ~~at the transmission destination~~. Here, if a packet of data ~~to be transmitted by each device~~ is a packet of audio data and the packet is about to be abandoned due to time-out, the radio terminals 2a to 2d according to the present embodiment are granted
10 a transmission right from the AP 1 through polling. Thus, the radio terminals 2a to 2d which have been granted the transmission right, ~~switches switch~~ the data communication method from CSMA/CA ~~technique to a~~ polling technique and, without abandoning the packet due to time-out, are able to transmit the packet to the
15 ~~counterparting counterpart~~ radio terminals 2a to 2d.

~~Here, in this radio communication system, when~~When a packet of audio data held by one of the radio terminals 2a to 2d is about to be abandoned, ~~in order for a transmission right to be granted to the radio terminals 2a to d holding the packet,~~ the AP 1 needs
20 to recognize ~~the timing~~ when a packet to be transmitted next to this packet would be abandoned due to time-out for a transmission right to be granted.

Therefore, the radio terminals 2a to 2d embed predetermined information in the packet of data ~~to be transmitted~~ and transmit
25 the packet to the AP 1 and the radio terminals 2a to 2d ~~at the~~

~~transmission destination.~~ Hereafter, the construction of the packet of data will be described with reference to the figures. FIG. 2 is a diagram illustrating the construction of a packet of data according to the present embodiment.

5 First, a packet of data according to the present embodiment comprises a control header 51, a payload section 54, a packet abandonment time area 52, a remaining packet flag area 53, and a frame check sequence (FCS) 55. The control header 51 is a header portion containing information such as a transmission destination
10 of this packet. The payload section ~~54 contains~~ 54 contains the actual data. The packet abandonment time area 52 contains information of a time (a packet abandonment time) until a subsequent packet to be transmitted ~~next to this packet will be~~ is abandoned due to time-out. For example, the packet abandonment time is
15 expressed by a number of 10 levels; and the packet abandonment time is ~~decremented~~ decreased by one ~~in every two seconds, and~~ when. When the number becomes 0, the subsequent packet ~~to be transmitted next to this packet~~ is abandoned.

The remaining packet flag area 53 shows whether a subsequent
20 packet ~~to be transmitted next to this packet itself exists or not.~~ More specifically, the remaining packet flag area 53 is expressed in data of 1 bit. If the bit ~~indicating, if it is 0, that a next~~ packet does not exist, and if it is 1, ~~that a next packet exists.~~ An FCS (Frame Check Sequence) is a 32-bit cyclic redundancy check
25 (CRC) for checking whether received data is correct or not.

Hereafter, ~~the detailed constitution of the~~ radio terminals 2a to 2d and the AP 1 in the radio information communicating system according to the present embodiment ~~will be~~is described with reference to the figures. FIG. 3 is a block diagram illustrating ~~the detailed constitution of the~~ radio terminals 2a to 2d according to the present embodiment. FIG. 4 is a block diagram illustrating the detailed constitution of a MAC/BB processing section 102a in the radio terminals 2a to 2d. In addition, FIG. 5 is a block diagram illustrating ~~the detailed constitution of the~~ AP 1 according to the present embodiment. FIG. 6 is a block diagram illustrating ~~the detailed constitution of the~~ MAC/BB processing section 102b in the AP 1 according to the present embodiment.

First, the radio terminals 2a to 2d according to the present embodiment perform data transmission/reception through mutual radio communication ~~and~~. Each of the radio terminals 2a to 2d comprise a high frequency processing section 101a, ~~the a~~ MAC/BB processing section 102a, a CPU 103a, a wired I/F 104 for a terminal, and a terminal 105.

The high frequency processing section 101a demodulates a radio signal transmitted from ~~the~~ one of the other radio terminals 2a to 2d or from the AP 1 and converts the radio signal to an electric signal; ~~in addition,~~. Additionally, the high frequency processing section 101a modulates an electric signal outputted from the MAC/BB processing section 102a and outputs the electric signal as a radio signal.

The MAC/BB processing section 102a, as shown in FIG. 4, comprises an internal CPU 201a, a frame processing section 202a, a sending/receiving FIFO 203a, a MAC protocol processing section 204a, and a bus bridge 205a, and switches between data communication based on CSMA/CA technique and data communication based on polling technique depending on the state of communication with the radio terminals 2a to 2d. The CPU 103a, shown in Fig. 3, controls the flow of a packet within the radio terminals 2a to 2d. More specifically, the CPU 103a forwards a packet inputted from an external network via the wired I/F 104 for the terminal to the MAC/BB processing section 102a, and forwards a packet outputted from the MAC/BB processing section 102a to the wired I/F 104 for the terminal. The terminal 105 is an information terminal such as a personal computer and creates a packet to be transmitted.

Now, each constituent section of the MAC/BB processing section 102a will be described below. The bus bridge 205a connects two busses and outputs the packet outputted from the wired I/F 104 for the terminal to the frame processing section 202a. The frame processing section 202a adds the packet abandonment time area 52 and the remaining packet flag area 53 to the packet of data to be transmitted and outputs the packet to the sending/receiving FIFO 203a. The sending/receiving FIFO 203a outputs the packet to the high frequency processing section 101a, based on an instruction from the MAC protocol processing section 204a. The MAC protocol processing section 204a normally performs

carrier sensing for a radio transmission line by CSMA/CA technique and, if the radio transmission line is in an open state, the MAC protocol processing section 204a instructs the sending/receiving FIFO 203a to output the packet. Additionally, if a transmission
5 right is granted from the AP 1 through polling, the MAC protocol processing section 204a causes the sending/receiving FIFO 203a to transmit the packet held thereby. The internal CPU 201a measures time, and periodically accesses the sending/receiving FIFO 203a, and ~~decrements~~ decreases the packet abandonment time area 52 of
10 the packet stored in the sending/receiving FIFO 203a by one each. Note that the cycle with which the internal CPU 201a accesses the sending/receiving FIFO 203a and the time taken for the packet abandonment time area 52 to be ~~decremented~~ decreased by one, need to be matched.

15 Next, with reference to the figures, the AP 1 will be described. FIG. 5 is a block diagram illustrating ~~the entire constitution of~~ the AP 1. The AP 1 and the radio terminals 2a to 2d have substantially the same hardware ~~constitution~~. Consequently, and any ~~constituent element realized by~~ having the same hardware is
20 denoted by the same reference numeral with the end "a" being replaced with "b".

The AP 1 transmits ~~the packet~~ packets of data inputted from the external network to the radio terminals 2a to 2d in the form of electric waves, and receives ~~the electric waves~~ transmitted
25 from the radio terminals 2a to 2d and transmits ~~the packet~~ packets

of data to the external network. The AP1 comprises a high frequency processing section 101b, a MAC/BB processing section 102b, a CPU 103b, and an Ethernet (R) I/F 304.

Here, the high frequency processing section 101b is identical
5 to the MAC/BB processing section 102a of the radio terminals 2a to 2d, and therefore, the description is omitted.

The MAC/BB processing section 102b, as shown in FIG. 6, includes an internal CPU 201b, a frame processing section 202b, a sending/receiving FIFO 203b, a MAC protocol processing section
10 204b, and a bus bridge 205b, and switches data communication by CSMA/CA technique to data communication by polling technique in accordance with the state of communication with the radio terminals 2a to 2d. The CPU 103b controls the flow of a packet within the AP1. More specifically, the CPU 103b forwards the packet inputted
15 from the external network via the Ethernet (R) I/F 304 to the MAC/BB processing section 102b, and forwards the packet outputted from the MAC/BB processing section 102b to the Ethernet (R) I/F 304. The Ethernet (R) I/F 304 converts the format of the packet from a format appropriate for the external network to a format
20 appropriate for the wireless LAN network, and converts the format of the packet from a format appropriate for the wireless LAN network to a format appropriate for the external network.

~~Here, each~~ Each constituent section of the MAC/BB processing section 102b ~~will be~~ is described below. The bus bridge
25 205b is identical to the bus bridge 205a of the radio terminals

2a to 2d, and therefore the description is omitted. The frame processing section 202b acquires the packet abandonment time area 52 and the remaining packet flag area 53 from the received packet. ~~To the sending/receiving FIFO 203, the~~The received packet of data
5 is stored temporarily in the sending/receiving FIFO 203. The internal CPU 201b measures time, accesses the frame processing section 202b periodically, and decrements the packet abandonment time for the packet acquired by the frame processing section 202b by one each. If a next packet is not received even when the packet
10 abandonment time of the packet received last is 1, the MAC protocol processing section 204b creates a polling packet for the purpose of granting a transmission right to the radio terminals 2a to 2d based on polling.

An operation of the radio information communicating system
15 constituted as above will be described below. Each process presented in the present embodiment can be realized ~~software-wisely~~with software using a computer, or by using a dedicated hardware circuit conducting each ~~such~~ process.

A case where the radio terminal 2a transmits data to the
20 radio terminal 2b will be described. ~~In the case where~~When the radio terminal 2a transmits data to the radio terminal 2b, ~~first,~~ each area, such as the packet abandonment time area 52, is embedded to the packet of data to transmit. Therefore, ~~firstly,~~ with reference to FIG. 7, an operation of the radio terminal 2a ~~at this point of time will be~~is described below. FIG. 7 is a flowchart
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illustrating an operation of the frame processing section 202a of the MAC/BB processing section 102a in the radio terminal 2a at the time of the packet transmission from the radio terminal 2a to the radio terminal 2b, when each area ~~such as the packet~~
5 ~~abandonment time area 52~~ is embedded into each packet.

First, the terminal 105 outputs the packet of data to be transmitted to the wired I/F 104 ~~for the terminal~~. In response, the wired I/F 104 ~~for the terminal~~ converts the received packet from a format appropriate for the terminal 105 to a packet format
10 appropriate for the wireless LAN and, in accordance with an instruction from the CPU 103a, outputs the packet to the MAC/BB processing section 102a.

The packet inputted to the MAC/BB processing section 102a is inputted to the frame processing section 202a via the bus bridge
15 205a and a bus. The frame processing section 202a thereby acquires the packet (step S5).

Next, the frame processing section 202a determines whether the packet acquired is an audio packet ~~or not~~ (step S7). If the acquired packet is not an audio packet, the process proceeds to
20 step S15. ~~On the other hand, if the acquired packet is an audio packet~~ Otherwise, the process proceeds to step S10.

If the acquired packet is an audio packet at step S10, the frame processing section 202 adds the control header 51, the packet abandonment time area 52, the remaining packet flag area 53, and
25 the FCS 55 to the acquired packet ~~(step S10)~~. ~~Here, the~~ The frame

processing section 202 embeds the number "10" in the packet abandonment time area 52, and embeds the number "1", indicative of an existence of a next or subsequent packet, in the remaining packet flag area 53. If a next or subsequent packet does not exist, 5 the frame processing section 202 embeds the number 0 in the remaining packet flag area 53. Thereafter, the process proceeds to step S15.

At the ~~above-mentioned~~ step S15, the frame processing section 202 outputs the packet held thereby to the sending/receiving FIFO 203a ~~(step S15)~~. After this, the process Processing then returns 10 to step S5 and the frame processing section 202 performs a ~~process identical to the aforementioned~~ the same process for the next or subsequent packet. Thus, packets are successively inputted to the sending/receiving FIFO 203a from the frame processing section 15 202. The packets will thus be stored in the sending/receiving FIFO 203a.

Among the packets stored in the sending/receiving FIFO 203a, the MAC protocol process section 204a transmits the first packet of the data to be transmitted, through CSMA/CA ~~technique~~. 20 Specifically, the MAC protocol process section 204a performs carrier sensing for a radio transmission line which the device is going to use for a ~~packet transmission~~, and if the radio transmission line comes to an open state, transmits the packet ~~based on using~~ CSMA/CA ~~technique~~. In the present embodiment, 25 because the radio terminal 2a is trying to transmit the packet

to the radio terminal 2b, the radio terminal 2a monitors the usage state of the radio transmission line between the radio terminal 2a and ~~the~~ 2b.

If the MAC protocol process section 204a determines that
5 a transmission of data is possible, the first packet of the data to be transmitted, among the packets stored in the sending/receiving FIFO 203a, is outputted to the high frequency processing section 101a, subjected to ~~a~~ an RF process at the high frequency processing section 101a, and then transmitted to the
10 AP 1 and the radio terminal 2b. In response, the AP 1 and the radio terminal 2b receive the packet transmitted from the radio terminal 2a. The packet, according to the present embodiment, is transmitted to both the AP 1 and the radio terminals 2a to 2d ~~at the transmission destination~~. This is in order to allow the
15 AP 1 to recognize when the next or subsequent packet to the transmitted packet ~~which has been transmitted~~ is to be abandoned.

~~Here, the~~ The transmitting radio terminal 2a ~~at the transmitting end~~ must manage the time ~~with~~ in which the next or subsequent packet ~~which it is holding~~ will be abandoned. Therefore,
20 an operation performed by the internal CPU 201a in the radio terminal 2a, when the packet is stored in the sending/receiving FIFO 203a of the radio terminal 2a, ~~will be~~ is described below with reference to the figures. FIG. 8 is a flowchart illustrating the operation which the internal CPU 201a performs at this time.

25 ~~Firstly, it is assumed that~~ In the present embodiment, one

or more packets are stored in the sending/receiving FIFO 203.

The internal CPU 201a measures time and accesses the sending/receiving FIFO 203a at the predetermined time interval ~~of every predetermined time~~. As mentioned above, the
5 ~~predetermined time herein is the time which it takes for to decrease~~
the packet abandonment time ~~to be decremented by one, and in~~. In
the present embodiment, ~~it~~ the predetermined time is two seconds.

~~Here, the~~ The internal CPU 201 determines whether the
predetermined time has elapsed ~~or not~~ since previously accessing
10 the sending/receiving FIFO 203 (step S50). If the predetermined
time has not elapsed ~~yet~~, the process returns to step S50. ~~On~~
~~the other hand, if the predetermined time has elapsed~~ Otherwise,
the process proceeds to step S55.

If the predetermined time has elapsed, the internal CPU 201
15 refers to the packet abandonment time area 52 of the packet stored
in the sending/receiving FIFO 203a (step S55). Then, the internal
CPU 201 ~~rewrites~~ decreases the value of the referred packet
abandonment time ~~to a value decremented by one~~ (step S60).

Next, whether the packet currently in process is the last
20 packet among that stored in the sending/receiving FIFO 203a ~~or~~
~~not~~ is determined (step S65). This determination process takes
place by referring to the remaining packet flag area 53. ~~Here,~~
~~if~~ If it is the last packet, since the packet abandonment time of
all packets is rewritten, the process returns to step S50. ~~On~~
25 ~~the other hand, if it is not the last packet~~ Otherwise, the process

proceeds to step S70.

If it is not the last packet, the internal CPU 201a refers to a next or subsequent packet within the sending/receiving FIFO 203a (step S70). Thereafter, the process returns to step S55 and
5 the internal CPU 201a applies processes similar to step S55 and step 60 to the packet referred at step S70.

Through the above operation, the packet abandonment time is managed in the transmitting radio terminal 2a, ~~which is a terminal at the transmitting end.~~

10 Next, operations to be performed when the radio terminal 2b and the AP 1 receive a packet transmitted from the radio terminal 2a will be described. ~~First, since~~ Because the process performed when the radio terminal 2b receives a packet is the same as a process performed by a conventional commonly-used wireless LAN system,
15 the description is omitted.

~~On the other hand, since the~~ The process performed when the AP 1 receives a packet ~~greatly differs from that in a conventional wireless LAN system, the process is described with reference to the figures.~~ FIG. 9 is a ~~block diagram~~ flowchart illustrating an
20 operation performed by the MAC/BB processing section 102b of the AP 1 ~~at this time.~~

~~First, a~~ A packet transmitted from the radio terminal 2a is received by the high frequency processing section 101b. The high frequency processing section 101b converts the received packet
25 to a format capable of being processed at the MAC/BB processing

section 102b, and outputs the received packet to the MAC/BB processing section 102b. In response, the frame processing section 202b of the MAC/BB processing section 102b acquires the packet (step S100).

5 The frame processing section 202b ~~which has acquired the packet refers to the acquired packet in order to determine~~determines whether the packet is an audio packet ~~or not~~ (step S105). ~~Here, the~~The determination as to whether it is an audio ~~frame or not~~packet is conducted through determining whether
10 the remaining packet flag area 53 and the packet abandonment time area 52 exist in the packet ~~or not~~. If the ~~acquired packet~~ is an audio packet, the process proceeds to step S110. ~~On the other hand, if the acquired packet is not an audio packet~~Otherwise, the process ~~is ended~~ends.

15 If the ~~acquired packet~~ is an audio packet, the frame processing section 202b refers to the remaining packet flag area 53 to determine whether a next packet ~~to come transmitted exists or not~~ (step S110). This determination is made through determining whether the number in the remaining packet flag area 53 is "1"
20 ~~or not~~. If a subsequent packet exists, the process proceeds to step S115. ~~On the other hand, if a subsequent packet does not exist~~Otherwise, the process ~~is ended~~ends.

 If a subsequent packet exists, the frame processing section 202b acquires the packet abandonment time area 52 contained in
25 the ~~acquired packet~~ (step S115). Then, the frame processing

section 202b outputs the packet to the sending/receiving FIFO 203b.

The internal CPU 201b measures time in synchronization with the internal CPU 201a of the radio terminals 2a to 2d, and accesses the frame processing section 202 with the same timing as the internal
5 CPU 201a accesses the sending/receiving FIFO 203a, at the predetermined time interval of every predetermined time. The predetermined time ~~herein~~ is the time ~~which it takes to decrease~~ the number in the packet abandonment time area 52 ~~to be decremented~~ by one, ~~and~~. The predetermined time is two seconds in the present
10 embodiment.

The internal CPU 201b determines whether the predetermined time has elapsed ~~or not~~ since previously accessing the frame processing section 202b (step S120). If the predetermined time has elapsed, the process proceeds to step S125. ~~On the other hand,~~
15 ~~if the predetermined time has not yet elapsed~~ Otherwise, the process returns to step S120.

If the predetermined time has elapsed, the internal CPU 201b accesses the frame processing section 202b and ~~rewrites~~ decreases the number contained in the packet abandonment time area 52 ~~acquired~~
20 ~~by the frame processing section 202b to a number decremented by~~ one (step S125). Next, the frame processing section 202b refers to the packet abandonment time area 52 to determine whether the packet abandonment time is "1" ~~or not~~ (step S130). If the packet abandonment time is "1", the process proceeds to step S135. ~~On~~
25 ~~the other hand, if the packet abandonment time is not "1",~~

~~since~~Otherwise, because there is enough time left till the next packet is abandoned, the process returns to step S120.

If the packet abandonment time is "1", the internal CPU 201b determines whether the AP 1 has received a next or subsequent packet to the packet currently being processed ~~or not~~ (step S135). If a next or subsequent packet has been received, the process returns to step S115 and the MAC/BB processing section 102b conducts the processes of step S115 to step S135 for the next packet. ~~On the other hand, if a next packet has not been received~~Otherwise, the process proceeds to step S140.

If a next packet has not been received, the internal CPU 201b notifies ~~so to~~ the MAC protocol processing section 204b. In response, the MAC protocol processing section 204b creates a polling packet for the purpose of granting a transmission right to the radio terminal 2a (step S140). The MAC protocol processing section 204b ~~which has created the polling packet~~ transmits the polling packet to each of the radio terminals 2a to 2d in the wireless LAN area via the high frequency processing section 101b (step S145). The radio terminal 2a is thereby granted a transmission right based on polling ~~technique~~. Thereafter, in response to the polling packet, the packet is transmitted from the radio terminal 2a; at step S100, the packet is received.

Next, an operation at the time when the radio terminal 2a transmits a subsequent packet to the radio terminal 2b will be described. As mentioned above, the first packet is transmitted

to the radio terminal 2b at the transmitted end through CSMA/CA technique.

~~On the other hand, the second and later~~Otherwise, subsequent packets are transmitted through CSMA/CA technique in principle.

5 When ~~the a~~ packet is about to be abandoned due to time-out, the ~~second and later~~subsequent packets are transmitted through polling technique. Now, with reference to the figures, an operation performed by the MAC/BB processing section 102a of the radio terminal 2a when the ~~second and later~~subsequent packets are
10 transmitted will be described below. FIG. 10 is a flowchart illustrating an operation performed by the MAC/BB processing section 102a ~~of the radio terminal 2a described above.~~

~~First, based on~~Using CSMA/CA technique, the MAC protocol processing section 204a performs carrier sensing for a radio
15 transmission line which the device is trying to use (step S200). Next, the MAC protocol processing section 204a determines if it is possible to transmit a packet ~~or not, through~~by determining whether the radio transmission line is available ~~or not~~ (step S205). If it is possible to transmit a packet, the process proceeds to
20 step S210. ~~On the other hand, if it is not possible to transmit a packet~~Otherwise, the process proceeds to step S215.

If it is possible to transmit a packet, the MAC protocol processing section 204a causes the oldest packet among the packets stored in the sending/receiving FIFO 203a to be transmitted to
25 the AP 1 and to the radio terminal 2b, via the high frequency

processing section 101a (step S210). In response, the AP 1 and the radio terminal 2b receive the packet. ~~In the AP 1 having received the packet~~ Upon receiving the packet at the AP 1, the process presented in the flowchart of FIG. 9 is conducted. Thereafter, 5 the process returns to step S200 and a similar process is performed for the next or subsequent packet.

~~On the other hand, if~~ If it is not possible to transmit the packet, the MAC protocol processing section 204a determines whether a polling packet from the AP 1 has been received ~~or not~~ (step S215). 10 If a polling packet has been received, the process proceeds to step S220. ~~On the other hand, if a polling packet has not been received~~ Otherwise, the process returns to step S200.

If a polling packet has been received, it indicates that the radio terminal 2a is granted a transmission right to transmit 15 the packet to the radio terminal 2b. Therefore, the radio terminal 2a transmits the oldest packet among the packets stored in the sending/receiving FIFO 203a to the AP 1 and to the radio terminal 2b via the high frequency processing section 101b (step S220). In response, the AP 1 and the radio terminal 2b receive the packet. 20 ~~In the AP 1 having received the packet~~ Upon receiving the packet at the AP 1, the process shown in the flowchart of FIG. 9 is conducted. Thereafter, the process returns to step S200 and a similar process is performed for the next packet.

As aforementioned, in accordance with the radio information 25 communicating system of the present embodiment, since an AP grants

a radio terminal a transmission right based on polling when a packet is about to be abandoned, abandonment of a packet is avoided.

Furthermore, since control using polling technique only takes place when a packet is about to be abandoned and is not
5 conducted constantly, the control load on the AP is reduced as compared to the case where control using polling technique is always performed.

In the present embodiment, packet communication between radio terminals is only described; however, this method of data
10 communication is also applicable to the case where a packet is transmitted from a radio terminal to an AP. In this case, the function of the MAC/BB processing section in the AP should only be the same as that of the MAC/BB processing section in the radio terminal. The packet transmitted from a radio terminal to an AP
15 may be a packet transmitted to an external network or may also be a packet transmitted to a radio terminal within the wireless LAN.

~~INDUSTRIAL APPLICABILITY~~

20 ~~A~~ The radio information communicating system according to the present invention as described herein has an effect of being controllable in such a manner that specific data such as audio data will not be abandoned within a radio terminal at the transmitting end due to time-out, without imposing a heavy control
25 load on the whole system. ~~The~~ Moreover, the radio information

communicating system ~~according to the present invention~~as
described herein is effective as a radio information communicating
system, or the like, in which one access relaying apparatus and
one or more radio communication terminals constitute a local
5 network to mutually perform radio data communication.

ABSTRACT

~~In a radio information communicating system of the present invention, a~~
A radio terminal (2a) normally transmits a packet by
5 Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)
~~technique~~. In the packet is embedded a time in which a packet
to be next transmitted will be abandoned in the radio terminal
(2a) due to time-out. ~~Here, an~~An AP 1 monitors such information
and when a packet which the radio terminal (2a) is trying to transmit
10 is about to be abandoned in the radio terminal (2a) due to time-out,
grants to the radio terminal (2a) a transmission right based on
polling ~~technique~~. Thus, there is provided a wireless LAN system
which is controllable in such a manner that specific data such
as audio data will not be abandoned within a radio terminal at
15 the transmitting end due to time-out, without imposing a heavy
control load on the whole system.